

## PUSH BUTTON SWITCH

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

5       The present invention relates to a push button switch suitable for, e.g., a shutter release mechanism of a camera.

#### 2. Description of the Related Art

10       In typical conventional push button switches, a switching element and a push button are coaxially arranged so that a push stub of a push button, which is positioned on the axis of the push button, presses a press portion of the switching element when the push button is depressed. In the case where a return spring for returning the push  
15       button to its initial position after the push button is depressed is a coil spring, the coil spring is usually positioned around the push stub.

20       In the camera currently under development for the assignee of the present invention, a switching element cannot be arranged coaxially with respect to the push button due to the pursuit of further miniaturization of the camera.

### SUMMARY OF THE INVENTION

25       The present invention provides a push button switch

suitable for the case where a switching element cannot be arranged coaxially with respect to a push button.

The present invention provides such a push button switch which has a push button having a long stroke, e.g.,  
5 a shutter release button of a camera for switching ON a first switch for photometering and a second switch for a shutter releasing operation when half depressed and fully depressed, respectively.

According to an aspect of the present invention,  
10 a push button switch is provided, including a push button positioned on a switch base to be supported thereby in a manner to prevent the push button from coming off the switch base; a biasing member positioned between the push button and the switch base at a substantially center of  
15 the push button to bias the push button in a direction away from the switch base; a switching element having a press portion, the switching element being provided at a position offset from an axis of the push button; a press projection and a rocking projection which are formed on  
20 the push button on opposite sides of the center thereof, respectively, the press projection projecting to be associated with the press portion of the switching element; and a fulcrum formed on the switch base to be associated with the rocking projection. The rocking  
25 projection and the fulcrum are disengaged from each other

when the push button is in a non-depressed position. The rocking projection comes into contact with the fulcrum when the push button is half depressed. The push button turns about the fulcrum when the push button is further  
5 depressed following the half depression of the push button.

The biasing member can be a coil spring.

It is desirable for the half depression of the push button to cause the press projection to half press the  
10 press portion of the switching element so as to perform a first switching operation. It is desirable for the further depression of the push button, following the half depression of the push button, to cause the press projection to further press the press portion of the  
15 switching element so as to perform a second switching operation.

It is desirable for each of the fulcrum and the rocking projection to be elongated in a direction substantially orthogonal to a straight line connecting the  
20 center of the push button and the press projection of the push button.

It desirable for respective contacting surfaces of the press projection and the rocking projection, which come into contact with each other when the push button is  
25 half depressed, to be one and the other of a concave

cylindrical surface and a convex cylindrical surface.

The push button can have an oval shape in plan view, and each of the press projection and the rocking projection can be elongated in a major axis of the push button.

5        It is desirable for the push button switch to be incorporated in a camera so that the push button serves as a shutter release button. The switch base can include an outer flange portion, a cylindrical portion and a bottom wall, in that order in a direction from top to bottom of  
10 the camera. The cylindrical portion can be fitted in a hole formed on an exterior wall of the camera.

It is desirable for the rocking projection to come into contact with the fulcrum while the press projection half presses the press portion of the switching element  
15 when the push button is half depressed, and for the push button to turn about the fulcrum so that the press projection fully presses the press portion of the switching element when the push button is fully depressed following the half depression of the push button.

20        It is desirable for the switching element to be positioned below the switch base, wherein a through hole is formed on the switch base so that the press projection can press the press portion of the switching element through the through hole when the push button is depressed.

25        It is desirable for the switching element to include

a photometric switch and a release switch. The press projection half presses the press portion of the switching element to switch ON the photometric switch when the shutter release button is half depressed, and the press  
5 projection fully presses the press portion of the switching element to switch ON the release button when the shutter release button is fully depressed following the half depression of the shutter release button.

In an embodiment, a shutter release mechanism of  
10 a camera is provided, including a switch base having a recess which is fixed to an exterior wall of the camera; a shutter release button fitted in the recess to be freely movable in the recess along an axis of the shutter release button within a predetermined range of movement; a spring  
15 for biasing the shutter release button in a direction away from a bottom wall positioned at the bottom of the recess; a switching element positioned below the switch base, and having a press portion which is disposed at a position offset from an axis of the shutter release button; a press  
20 projection and a rocking projection which are formed on the shutter release button to project inwards, toward the bottom wall of the switch base, from opposite ends of the shutter release button, respectively, the press projection projecting so as to face the press portion of  
25 the switching element through a through hole formed on the

switch base; and a fulcrum formed on the switch base to face the rocking projection. The rocking projection and the fulcrum are disengaged from each other when the shutter release button is in a non-depressed position. The rocking projection comes into contact with the fulcrum while the press projection half presses the press portion of the switching element when the shutter release button is half depressed. The shutter release button turns about the fulcrum while the press projection fully presses the press portion of the switching element when the shutter release button is fully depressed following the half depression of the shutter release button.

The present disclosure relates to subject matter contained in Japanese Patent Application No.2003-001476 (filed on January 7, 2003) which is expressly incorporated herein by reference in its entirety.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be discussed below in detail with reference to the accompanying drawings, in which:

Figure 1 is an exploded perspective view of an embodiment of a push button switch according to the present invention;

Figure 2 is a plan view of the push button switch shown in Figure 1 with a button cap of the push button

switch removed;

Figure 3 is a cross sectional view taken along III-III line shown in Figure 2, showing a non-operational state of the push button switch;

5        Figure 4 is a cross sectional view taken along III-III line shown in Figure 2, showing an operational state of the push button switch;

Figure 5 is a cross sectional view taken along V-V line shown in Figure 2; and

10        Figure 6 is a cross sectional view taken along VI-VI line shown in Figure 2.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

Figure 1 shows an embodiment of a push button switch  
15    according to the present invention which serves as a shutter release mechanism of a camera. A through hole 12 is formed on an upper exterior member 11 of the camera 10 so that a switch base 20 made of synthetic resin is fitted in the through hole 12. The through hole 12 has an oval  
20    shape in plan view which is elongated in a horizontal direction of the camera 10. The switch base 20 is provided with an outer flange portion 22, a cylindrical portion 21 and a bottom wall 23, in that order in a direction from top to bottom of the camera 10. The cylindrical portion  
25    21 has an oval shape in plan view which corresponds to that

of the through hole 12. The outer flange 22 projects radially outwards from the upper end of the cylindrical portion 21 to form a rim around the upper edge of the through hole 12. The bottom wall 23 closes the lower end  
5 of the cylindrical portion 21. The bottom wall 23 is provided at substantially the center of an upper surface of the bottom wall 23 with a spring positioning stub 24. The bottom wall 23 is provided in front of the spring positioning stub 24 with a through hole 25, and is further  
10 provided, behind the spring positioning stub 24 on an upper surface of the bottom wall 23, with an elongated fulcrum 26 which is elongated in a horizontal direction of the camera 10. The elongated fulcrum 26 is formed as an elongated projection having a semi-cylindrical cross  
15 section to have a convex cylindrical surface on the elongated fulcrum 26. The elongated fulcrum 26 is elongated in a direction substantially orthogonal to a straight line connecting the spring positioning stub 24 with the through hole 25, and is also elongated in the  
20 direction of the major axis of the through hole 12 (the cylindrical portion 21). The switch base 20 is provided, at opposite ends of the bottom wall 23 in the direction of the major axis of the cylindrical portion 21, with a pair of engaging holes 27 which are formed over the lower  
25 edge of the cylindrical portion 21 and the bottom wall 23.



The shutter release mechanism of the camera 10 is provided, inside the upper exterior member 11 immediately below the switch base 20, with a switching element 13 having tactile feedback which is fixed to an internal stationary portion of the camera 10. As shown in Figure 3, the axis of the switching element 13 is offset from the axis of the through hole 12 (in a direction substantially orthogonal to a straight line connecting the spring positioning stub 24 with the through hole 25) so that a top center of the switching element 13 which is to be pressed with tactile feedback, i.e., a press portion 13a of the switching element 13, is positioned immediately below the through hole 25 of the bottom wall 23. The switching element 13 is electrically connected to a CPU (not shown) of the camera 10 via a flexible PWB 14. The switching element 13 includes two switches (not shown): a photometric switch and a release switch which are switched ON when the press portion 13a of the switching element 13 is half depressed and fully depressed, respectively. The camera 10 is provided therein immediately below the upper exterior member 11 with a cylindrical element (e.g., cylindrical capacitor) C (see Figures 3 and 4) which is elongated in a horizontal direction of the camera 10. The cylindrical element C is partly positioned immediately below the switch base 20 as

shown in Figures 3 and 4, thus preventing the switching element 13 from being arranged coaxially with respect to the shutter release button 30 as a result of the pursuit of miniaturization of the camera 10.

5           The shutter release mechanism of the camera 10 is provided with a shutter release button (push button) 30. The shutter release button 30 is composed of a button body 31 and a button cap 32. The button body 31 is positioned inside the cylindrical portion 21 of the switch base 20, 10 while the button cap 32 made of metal is cemented to a top surface of the button body 31. The button body 31 is made of synthetic resin, and has an oval shape in plan view which corresponds to that of the cylindrical portion 21. The button body 31 is provided, at a center of an under surface 15 of a top wall of the button body 31, with a spring receiving recess (cylindrical recess) 33 which is recessed upwards, in a direction away from the spring positioning stub 24. The diameter of the spring receiving recess 33 is greater than the diameter of the spring positioning stub 24. The shutter release mechanism of the camera 10 is provided in 20 the space between the bottom wall 23 and the button body 31 with a coil spring (return spring) 35 having a truncated cone shape so that a small-diameter end of the coil spring 35 is fitted on the spring positioning stub 24 while a 25 large-diameter end of the coil spring 35 is fitted in the

spring receiving recess 33. The coil spring 35 always biases the shutter release button 30 upwards, in a direction away from the bottom wall 23 of the switch base 20. On the other hand, the button body 31 is provided, at opposite ends thereof in a direction of the major axis of the oval-shaped button body 31, with a pair of engaging legs 34 which are engaged in the pair of engaging holes 27 to prevent the button body 31 from coming off the switch base 20. Each engaging leg 34 is provided at a tip thereof with a claw 34a which is engaged with the top end of the associated engaging hole 27 when the shutter release button 30 is positioned at the upper moving limit thereof with respect to the switch base 20. Namely, the claws 34a of the pair of engaging legs 34 determine the upper moving limit of the shutter release button 30 with respect to the switch base 20, i.e., prevent the button body 31 from coming off the switch base 20.

The button body 31 is provided, on opposite sides of the spring receiving recess 33 in a direction of the minor axis of the button body 31 (in a vertical direction as viewed in Figure 2), with a press projection 36 and an elongated rocking projection 37. The press projection 36 projects toward the switching element 13 so that the tip of the press projection 36 passes through the through hole 25 to face the press portion 13a of the switching element

13. The elongated rocking projection 37 is elongated in a direction parallel to the elongated fulcrum 26, and is formed to have a semi-cylindrical cross section to correspond to the shape of the elongated fulcrum 26. A lower end surface of the elongated rocking projection 37, which comes into contact with the convex cylindrical surface of the elongated fulcrum 26 when the shutter release button 30 is depressed, is formed as a concave cylindrical surface.

As shown in Figure 3, the elongated rocking projection 37 and the elongated fulcrum 26 are disengaged from each other when the shutter release button 30 is in a non-depressed position where the shutter release button 30 does not sink into the cylindrical portion 21 of the switch base 20. The elongated rocking projection 37 comes into contact with the elongated fulcrum 26 and subsequently the shutter release button 30 turns about the elongated fulcrum 26 (the elongated rocking projection 37) when the shutter release button 30 is depressed as shown in Figure 4. The cylindrical portion 21 of the switch base 20 is provided on an inner peripheral surface thereof with a clearance recess 28 (see Figures 3 and 4) which is recessed toward the front of the camera 10 (rightward as viewed in Figures 3 and 4) to allow the shutter release button 30 to turn about the elongated fulcrum 26 (the

elongated rocking projection 37) while the axis of the shutter release button 30 tilts as shown in Figure 4.

Accordingly, in the above illustrated embodiment of the shutter release mechanism of the camera 10, the shutter release button 30, which is biased in a direction away from the bottom wall 23 of the switch base 20 by the coil spring 35, is held in the non-depressed position by the engagement of the pair of engaging legs 34 with the pair of engaging holes 27 while the press projection 36 is disengaged from the switching element 13 in a state where the shutter release button 30 is not depressed, i.e., the shutter release button 30 is in a free state as shown in Figure 3.

When the shutter release button 30 is depressed against the spring force of the coil spring 35, firstly the elongated rocking projection 37 comes into contact with the elongated fulcrum 26. This simple depression of the shutter release button 30 causes the press projection 36 to half depress the press portion 13a of the switching element 13 to thereby switch ON the photometric switch of the switching element 13. Subsequently, when the shutter release button 30 is further depressed (fully depressed) following the half depression of the shutter release button 30, the shutter release button 30 turns about the elongated fulcrum 26 (the elongated rocking projection 37)

to consequently fully press the press portion 13a of the switching element 13. This switches ON the release switch. When the shutter release button 30 is fully depressed, a portion of the shutter release button 30 enters the clearance recess 28 as shown in Figure 4.

Since the shutter release button 30 is always biased in a direction away from the bottom wall 23 of the switch base 20 by the coil spring 35 that is positioned in the center of the shutter release button 30, a linear depression of the shutter release button 30 is sensed by the user when the shutter release button 30 is firstly half depressed. Subsequently, when the shutter release button 30 is fully depressed after the elongated rocking projection 37 comes into contact with the elongated fulcrum 26, a non-linear depression of the shutter release button 30 is sensed by the user that is slightly different from the previous sensed touch because the shutter release button 30 turns about the elongated fulcrum 26 (the elongated rocking projection 37). However, no unnatural/uncomfortable sense of touch is felt by the user because the angle of rotation of the shutter release button 30 about the elongated fulcrum 26 (the elongated rocking projection 37) is only approximately a few degrees.

As can be understood from the above descriptions, the push button switch according to the present invention

is suitable for a push button switch with a long stroke,  
e.g., a shutter release mechanism of a camera. However,  
the push button switch according to the present invention  
can be applied to a push button switch for any other type  
5 electronic equipment.

As can be understood from the foregoing, according  
to the present invention, a push button switch suitable  
for the case where a switching element cannot be arranged  
coaxially with respect to a push button is achieved.

10 Obvious changes may be made in the specific  
embodiment of the present invention described herein, such  
modifications being within the spirit and scope of the  
invention claimed. It is indicated that all matter  
contained herein is illustrative and does not limit the  
15 scope of the present invention.